ELECTRONIC APPARATUS AND ELECTRONIC EQUIPMENT

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Abstract of **JP2006011470**

PROBLEM TO BE SOLVED: To compensate for the characteristic variations of a drive transistor.
SOLUTION: In response to the supply of a scanning signal by which a switching transistor Trs is turned on, a control signal for turning on a transistor Q is supplied to a power supply control line F. Data current Idata are flow through a route of a voltage supply line VL, the transistor Q, a first power supply line L1, a compensating transistor Trc, a switching transistor Trs, and a data line Xm. Voltage Vc1, corresponding to the data current Idata, is generated in a node N, stored in a storage capacitor C1 and is applied to the gate of a drive transistor Trd. A current Ids flowing into an organic EL element 210 can be determined by the data current Idata, without depending on the threshold voltage characteristics of the drive transistor Trd.
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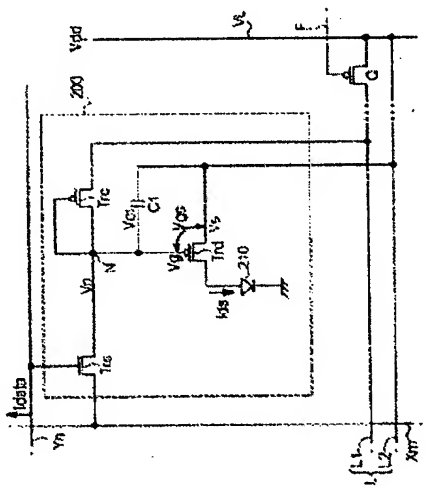

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(54) ELECTRONIC APPARATUS AND ELECTRONIC EQUIPMENT

(57)Abstract:

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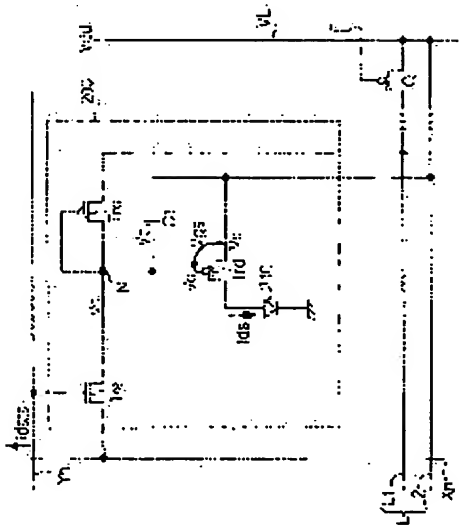
SOLUTION: In response to the supply of a scanning signal by which a switching transistor Trs is turned on, a control signal for turning on a transistor Q is supplied to a power supply control line F. Data current Idata are flow through a route of a voltage supply line VL, the transistor Q, a first power supply line L1, a compensating transistor Trc, a switching transistor Trs, and a data line Xm. Voltage Vc1, corresponding to the data current Idata, is generated in a node N, stored in a storage capacitor C1 and is applied to the gate of a drive transistor Trd. A current Ids flowing into an organic EL element 210 can be determined by the data current Idata, without depending on the threshold voltage characteristics of the drive transistor Trd.



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CLAIMS

[Claim(s)]
[Claim 1]
Two or more 1st signal wires,
Two or more 2nd signal wires,
Two or more unit circuits,
Two or more power source wires provided in accordance with the installation direction of two or more of said 1st signal wires are included,
Each of two or more of said unit circuits,
It has the 1st terminal, the 2nd terminal, and a drive transistor including the 1st gate,
By a data signal supplied to each of two or more of said unit circuits via the 2nd one signal wire among said two or more 2nd signal wires, switch-on of said 1st terminal and said 2nd terminal is set up,
An electronic device by which it is characterized.
[Claim 2]
In the electronic device according to claim 1,
Said 2nd terminal is connected to one power source wire in said two or more power source wires,
An electronic device by which it is characterized.
[Claim 3]
In the electronic device according to claim 2,
Each of two or more of said unit circuits contains a driven element further,
Said one power source wire and said driven element are electrically connected via said drive transistor,
An electronic device by which it is characterized.
[Claim 4]

In the electronic device according to any one of claims 1 to 3,
Each of two or more of said unit circuits contains a switching transistor further provided with the 2nd gate,
Said 2nd gate of said switching transistor is connected to the 1st one signal wire in said two or more 1st signal wires,
Sauce of said switching transistor or either of the drains is connected to said 2nd one signal wire,
An electronic device by which it is characterized.
[Claim 5]
In the electronic device according to claim 4,
Data currents are supplied as said data signal,
Said data currents flow through said switching transistor,
An electronic device by which it is characterized.
[Claim 6]
In the electronic device according to any one of claims 1 to 4,
Each of two or more of said unit circuits contains a compensation transistor further provided with the 3rd gate,
Sauce of said compensation transistor or either of the drains is connected to said 1st gate of said drive transistor,
An electronic device by which it is characterized.
[Claim 7]
In the electronic device according to claim 6,
Said 3rd gate is connected to said sauce of said compensation transistor, or either of said drains,
An electronic device by which it is characterized.
[Claim 8]
In the electronic device according to any one of claims 1 to 7,
The number of transistors contained in each of two or more of said unit circuits is three,
An electronic device by which it is characterized.
[Claim 9]
In the electronic device according to claim 6 or 7,
Transistors contained in each of two or more of said unit circuits are only said drive transistor, said switching transistor, and said compensation transistor,
An electronic device by which it is characterized.
[Claim 10]
In the electronic device according to claim 6,
A conductivity type of said compensation transistor and said drive transistor is the same,

An electronic device by which it is characterized.
[Claim 11]
In the electronic device according to claim 3,
Said gate voltage of said 1st gate is set as the 1st period,
Said one power source wire and said driven element are electrically connected via said drive transistor in the 2nd period,
An electronic device by which it is characterized.
[Claim 12]
In the electronic device according to claim 11,
Driving current is supplied to said driven element in said 2nd period,
A current level of said driving current is equivalent to said gate voltage of said 1st gate of said drive transistor,
An electronic device by which it is characterized.
[Claim 13]
In the electronic device according to claim 3,
Said driven element is an electrooptics element,
Each of two or more of said 1st signal wires functions as a scanning line,
Each of two or more of said 2nd signal wires functions as the data line,
An electronic device by which it is characterized.
[Claim 14]
In the electronic device according to claim 13,
Along with each of two or more of said 1st signal wires, an electrooptics element of the same color is arranged as said driven element,
An electronic device by which it is characterized.
[Claim 15]
Two or more 1st signal wires,
Two or more 2nd signal wires,
Two or more unit circuits,
Two or more 1st power source wires provided in accordance with the installation direction of two or more of said 1st signal wires,
Two or more 2nd power source wires are included,
Each of two or more of said unit circuits,
A driven element,
A drive transistor,
It has a switching transistor,
Said drive transistor is arranged between said driven element and the 2nd one power source wire in said two or more 2nd power source wires,

Switch-on of said drive transistor is set up via said switching transistor by data currents which flow between the 2nd one signal wire in said two or more 2nd signal wires, and the 1st one power source wire in said two or more 1st power source wires,
A current level of driving current supplied to said driven element corresponds to switch-on of said drive transistor,
An electronic device by which it is characterized.
[Claim 16]
In the electronic device according to any one of claims 1 to 15,
Said drive transistor is a p type transistor,
An electronic device by which it is characterized.
[Claim 17]
The electronic device according to any one of claims 1 to 16 was mounted,
Electronic equipment by which it is characterized.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
This invention relates to electronic devices, such as an electro-optic device, and electronic equipment.
[Background of the Invention]
[0002]
In recent years, the organic electroluminescence (Electronic Luminescence) element attracts attention as a next-generation light-emitting device which replaces the conventional LCD (Liquid Crystal Display) element. It has the characteristic outstanding as a display panel -- since an organic EL device is a spontaneous light type, since a back light and catoptric light are unnecessary, there is with low power consumption that there is little view angle dependence.
[0003]
As a conventional circuit (for example, patent documents 1) for driving such an organic EL device, the composition shown in drawing 14 is mentioned, for example. In this circuit, the drain of drive transistor Tr1 is connected to the current type driven element L (organic EL device) via the electrode for hole injections. Connect the gate of switching transistor Tr3 to the scanning line S, sauce is connected to data-line D, and the drain is connected to the gate of drive transistor Tr1, and the end of the capacitative element C, respectively. The other end of the capacitative element C is connected to the power source wire V. On-off control of switching transistor Tr3 is carried out by the selection potential supplied to a gate from the scanning line S, and the capacitative element C stores electricity an electric charge with the signal level supplied from data-line D during this one.
[0004]

And voltage is impressed to the gate of drive transistor Tr1 with the voltage between terminals of the capacitative element C produced by this electric charge, and the current Ids of the quantity according to this voltage is supplied to the driven element L from the power source wire V. According to the voltage impressed to the gate of drive transistor Tr1, the conductance between the source drains of drive transistor Tr1 is controlled, and, thereby, the luminosity of a L casks of driven element organic EL device is defined.

[0005]

[Patent documents 1] the [international publication] -- WO 98/No. 36407 pamphlet

[Description of the Invention]

[Problem(s) to be Solved by the Invention]

[0006]

However, in the manufacturing process of the display panel which applied the above-mentioned circuit, about the characteristic of the driven element L which constitutes a pixel. To the ability to constitute comparatively uniformly over each pixel of a display panel, about the characteristic of drive transistor Tr1. It is difficult to uniform over each pixel of a display panel by various conditions, such as construction material of the membraneous quality of semiconductor membrane, thickness and impurity concentration, a diffusion region, gate dielectric film, etc., etc., thickness, and operating temperature.

[0007]

When a thin film transistor constitutes each transistor in the above-mentioned circuit here, When it is easy to produce variation in the characteristic of each transistor and a display panel is constituted especially using the above-mentioned circuit, the variation in the characteristic of the current between drain sauce to the gate voltage of drive transistor Tr1 poses a problem. That is, even if it impresses voltage common to the gate of drive transistor Tr1 of each pixel, since the current amount which flows through an organic EL device changes for every pixel with existence of the above-mentioned variation, unevenness will arise in the light emitting luminance of each pixel, and the imaging quality of a display panel will be spoiled remarkably.

[0008]

The circuit for compensating the variation in the drive transistor which drives a current type driven element from such a situation is needed.

[0009]

The electronic device concerning this invention does a prominent effect so to the above-mentioned problem.

[Means for Solving the Problem]

[0010]

An electronic device concerning this invention Two or more 1st signal wires and two or more 2nd signal wires, Including two or more unit circuits and two or more power source wires

provided in accordance with the installation direction of two or more of said 1st signal wires, each of two or more of said unit circuits, With a data signal which is provided with the 1st terminal, the 2nd terminal, and a drive transistor including the 1st gate, and is supplied to each of two or more of said unit circuits via the 2nd one signal wire among said two or more 2nd signal wires. Switch-on of said 1st terminal and said 2nd terminal is set up.

[0011]

As for said 2nd terminal, in the above-mentioned electronic device, it is preferred to be connected to one power source wire in said two or more power source wires.

[0012]

As for each of two or more of said unit circuits, in the above-mentioned electronic device, it is preferred that said one power source wire and said driven element are electrically further connected via said drive transistor including a driven element.

[0013]

In the above-mentioned electronic device, each of two or more of said unit circuits, Furthermore, the 2nd gate including a switching transistor which it had said 2nd gate of said switching transistor, It is preferred that it is connected to the 1st one signal wire in said two or more 1st signal wires, and sauce of said switching transistor or either of the drains is connected to said 2nd one signal wire.

[0014]

In the above-mentioned electronic device, as said data signal, data currents are supplied and, as for said data currents, flowing through said switching transistor is preferred.

[0015]

In the above-mentioned electronic device, sauce of said compensation transistor or either of the drains may be connected to said 1st gate of said drive transistor including a compensation transistor which each of two or more of said unit circuits equipped with the 3rd gate further.

[0016]

Said 3rd gate may be connected to said sauce of said compensation transistor, or either of said drains in the above-mentioned electronic device.

[0017]

As for a transistor contained in each of two or more of said unit circuits, in the above-mentioned electronic device, it is preferred that they are only three pieces.

[0018]

In the above-mentioned electronic device, transistors contained in each of two or more of said unit circuits may be only said drive transistor, said switching transistor, and said compensation transistor.

[0019]

In the above-mentioned electronic device, the same thing of a conductivity type of said

compensation transistor and said drive transistor is preferred.

[0020]

As for said drive transistor, in the above-mentioned electronic device, it is preferred that it is a p type transistor.

[0021]

In the above-mentioned electronic device, it is preferred that said gate voltage of said 1st gate is set as the 1st period, and said one power source wire and said driven element are electrically connected via said drive transistor in the 2nd period.

[0022]

In the above-mentioned electronic device, driving current is supplied to said driven element in said 2nd period, and, as for a current level of said driving current, it is preferred to deal with said gate voltage of said 1st gate of said drive transistor.

[0023]

In the above-mentioned electronic device, said driven element is an electrooptics element, each of two or more of said 1st signal wires may function as a scanning line, and each of two or more of said 2nd signal wires may function as the data line.

[0024]

In the above-mentioned electronic device, an electrooptics element of the same color may be arranged as said driven element along with each of two or more of said 1st signal wires.

[0025]

Other electronic devices concerning this invention Two or more 1st signal wires and two or more 2nd signal wires, Including two or more unit circuits, two or more 1st power source wires provided in accordance with the installation direction of two or more of said 1st signal wires, and two or more 2nd power source wires, each of two or more of said unit circuits, Have a driven element, a drive transistor, and a switching transistor, and said drive transistor, It is arranged between said driven element and the 2nd one power source wire in said two or more 2nd power source wires, and via said switching transistor, By data currents which flow between the 2nd one signal wire in said two or more 2nd signal wires, and the 1st one power source wire in said two or more 1st power source wires. Switch-on of said drive transistor is set up and a current level of driving current supplied to said driven element corresponds to switch-on of said drive transistor.

[0026]

In the above-mentioned electronic device, it may be a p type of said drive transistor.

[0027]

The above-mentioned electronic device can be mounted in electronic equipment.

[0028]

A drive transistor by which an electronic circuit of this invention controls a current amount to a

driven element and said driven element, Direct continuation is carried out to a capacitative element connected to a gate of said drive transistor at said gate, Switch-on of said drive transistor is set up according to data currents which pass said compensation transistor including a compensation transistor by which diode connection was carried out and which are supplied as a data signal. According to this composition, since direct continuation of the compensation transistor is carried out to a gate of a drive transistor, these two transistors become easy [arranging the characteristic of those two transistors or adjusting a characteristic ratio], for example, as a result of approaching mutually and being provided. Data currents which pass a compensation transistor are directly reflected in a current amount controlled by a drive transistor. Said compensation transistor and the 1st switching transistor connected in series via either one of sauce or a drain are included here, Sauce of said 1st switching transistor or another side of a drain has preferred composition for which said data currents pass said compensation transistor, when it is connected to a signal wire and said signal wire and said compensation transistor are electrically connected via said 1st switching transistor.

[0029]

This invention for attaining the above-mentioned purpose, A driven element and a drive transistor which controls a current amount to said driven element, A capacitative element connected to a gate of said drive transistor, and the 1st switching transistor connected to a gate of said drive transistor, The 1st signal wire connected to a gate of said 1st switching transistor, The 2nd signal wire connected to sauce of said 1st switching transistor, or either of the drains, Are the unit circuit provided with a power source wire in which power supply voltage was impressed, and it has a compensation transistor and the 2nd switching transistor which were connected in series between said power source wire, sauce of said 1st switching transistor or any of a drain, or another side, Diode connection of said compensation transistor is carried out, and a gate of said 2nd switching transistor is characterized by composition connected to the 3rd different signal wire from said 1st signal wire. A driven element by which the current drive of this invention is carried out and a drive transistor which controls a current amount to said driven element, A capacitative element connected to a gate of said drive transistor, and the 1st switching transistor connected to a gate of said drive transistor, The 1st signal wire connected to a gate of said 1st switching transistor, The 2nd signal wire connected to sauce of said 1st switching transistor, or either of the drains, Are the unit circuit provided with a power source wire in which power supply voltage was impressed, and it has a compensation transistor and the 2nd switching transistor which were connected in series between said power source wire, sauce of said 1st switching transistor or any of a drain, or another side, Diode connection of said compensation transistor is carried out, and a gate of said 2nd switching transistor is characterized by composition connected to said 1st signal wire. Also in which composition, it becomes possible to compensate variation in a drive transistor.

Here, since a gate of the 1st and 2nd switching transistors will be connected to the 1st same signal wire in a direction of composition of starting the latter if the former is compared with the latter, the 3rd signal wire becomes unnecessary and it becomes possible to reduce a wiring number. A transistor by which diode connection was carried out means a transistor which has either one of the sauce or a drain in the state where it was connected to a gate. In composition concerning the former, composition in which a period when both said 1st switching transistor and said 2nd switching transistor will be in an ON state is provided is preferred.

[0030]

Here, in composition concerning the former and the latter, said 2nd signal wire has preferred composition which is the data line which supplies current as a data signal.

[0031]

Composition that said capacitative element stores electricity an electric charge according to a current amount which flows into said compensation transistor may be used.

[0032]

Although it is preferred in said drive transistor and said compensation transistor that a current characteristic between source drains to gate voltage is also the same in abbreviation, a current amount which flows into said compensation transistor may be larger composition than a current amount controlled by said drive transistor.

[0033]

It is desirable for said driven element to be an organic electroluminescence element.

[0034]

Although it is preferred that it is a thin film transistor, respectively as for said drive transistor, said 1st and 2nd switching transistors, and said compensation transistor, about said drive transistor, it is desirable that it is a p channel type with little aging.

[0035]

To achieve the above objects, while one [this invention] or turning off this invention according to a scanning signal supplied to the 1st scanning line, The 1st switching transistor by which either one of sauce or a drain was connected to the data line, A power source wire in which power supply voltage is impressed, sauce of said 1st switching transistor, or a drain is a compensation transistor and the 2nd switching transistor which were connected in series between another side either, A compensation transistor which functions as a diode, and the 2nd switching transistor one [the switching transistor] or turned off according to a scanning signal supplied to the 2nd different scanning line from said 1st scanning line, It is connected to sauce of said 1st switching transistor or any of a drain, or another side, and a gate is characterized by composition possessing a drive transistor which drives a driven element, and a capacitative element holding gate voltage of said drive transistor.

[0036]

While one [this invention] or turning off this invention according to a scanning signal supplied to the 1st scanning line, The 1st switching transistor by which either one of sauce or a drain was connected to the data line, A power source wire in which power supply voltage is impressed, sauce of said 1st switching transistor, or a drain is a compensation transistor and the 2nd switching transistor which were connected in series between another side either, A compensation transistor which functions as a diode, and the 2nd switching transistor one [the switching transistor] or turned off according to a scanning signal supplied to said 1st scanning line, It is connected to sauce of said 1st switching transistor or any of a drain, or another side, and a gate is characterized by composition possessing a drive transistor which drives a driven element, and a capacitative element holding gate voltage of said drive transistor. Also in which composition, it becomes possible to compensate variation in a drive transistor. Here, since a gate of the 1st and 2nd switching transistors will be connected to the same scanning line in a direction of composition of starting the latter if the former is compared with the latter, the 2nd scanning line becomes unnecessary and it becomes possible to reduce a wiring number.

[0037]

To achieve the above objects, while one [this invention] or turning off this invention according to a scanning signal supplied to a scanning line, A switching transistor by which either one of sauce or a drain was connected to the data line, The 1st power source wire in which the 1st power supply voltage is impressed in a period [one / a period / said switching transistor] of at least a part or all of a period, sauce of said switching transistor, or a drain either A compensation transistor which functions as a diode between another side, While a gate is connected to sauce of said switching transistor, or another side of a drain, It is connected to the 2nd power source wire in which the 2nd power supply voltage was impressed, and self sauce or one side of a drain is characterized by composition possessing a drive transistor which drives a driven element, and a capacitative element holding gate voltage of said drive transistor.

[0038]

While a gate is connected to a scanning line with which a scanning signal is supplied, this invention, A switching transistor by which either one of sauce or a drain was connected to the data line, It is the compensation transistor by which a gate was connected to sauce or a drain, Either one of sauce or a drain is connected to the 1st power source wire in which the 1st power supply voltage is impressed in a period [one / according to said scanning signal / a period / said switching transistor] of at least a part or all of a period, On sauce of said switching transistor or any of a drain, or another side, self sauce or a drain either A compensation transistor to which another side was connected, While a gate is connected to sauce of said switching transistor, or another side of a drain, Self sauce or one side of a drain is connected to the 2nd power source wire in which the 2nd power supply voltage was impressed, and it is

characterized by composition possessing a drive transistor which drives a driven element, and a capacitative element by which an end was connected to a gate of said drive transistor. Also in which composition, while compensating variation in a drive transistor, it becomes possible to reduce one transistor.

[0039]

Here, said 1st power supply voltage and said 2nd power supply voltage are omitted, and are, and their things are desirable.

[0040]

Various electronic devices, such as an electro-optic device, memory storage, and a sensor unit, may be constituted using at least one above-mentioned unit circuit. For example, if the above-mentioned unit circuit is used as a pixel circuit, it is possible to constitute an electro-optic device. Such an electro-optic device may be mounted in electronic equipment.

[0041]

To achieve the above objects, this invention is two or more unit circuits an electronic circuit to include, and each of two or more of said unit circuits, A drive transistor containing the 1st terminal and 2nd terminal and a compensation transistor to which said 3rd terminal was connected at a gate of said drive transistor including the 3rd terminal and 4th terminal, A switching transistor by which said 5th terminal was connected to a gate and said 3rd terminal of said drive transistor including the 5th terminal and 6th terminal, While holding charge quantity according to current which flows via said compensation transistor and said switching transistor, A capacitative element to which an end was connected at a gate of said drive transistor is included, Said 4th terminal is connected to the 1st power source wire with said 4th terminal of others and a unit circuit among said two or more unit circuits, It is connected to the 2nd power source wire, and said 2nd terminal is characterized by composition provided with a control circuit which sets said 1st power source wire as two or more potential, or controls cutting and connection between said 1st power source wire and power supply potential. According to this composition, threshold voltage of a drive transistor can be compensated with simple composition.

[0042]

In this electronic circuit, no transistors other than said drive transistor, said compensation transistor, and said switching transistor exist in each of said unit circuit. therefore, the number of a transistor to be used is reduced by one piece compared with the conventional thing, compensating threshold voltage of a drive transistor -- things can be carried out.

[0043]

As for said compensation transistor, that gate is connected to said 3rd terminal in this electronic circuit. Therefore, current which flows through a drive transistor is controllable by voltage charged by capacitative element.

[0044]
In this electronic circuit, a conductivity type of said drive transistor and said compensation transistor is the same. According to this, a drive transistor can be compensated easily.
[0045]
An electronic device is connected to said 1st terminal in this electronic circuit. Since threshold voltage of a drive transistor is compensated, a current value which flows into an electronic device is controllable with sufficient accuracy. As an electronic device, it is a driven element by which a current drive is carried out.
[0046]
In this electronic circuit, said control circuit is a transistor containing the 7th terminal and 8th terminal, said 7th terminal is connected to a power supply, and said 8th terminal is connected to said 1st power source wire. According to this, a control circuit can be constituted easily.
[0047]
a period when current is flowing via said compensation transistor and said switching transistor in this electronic circuit -- potential of said 1st power source wire and said 2nd power source wire at least is set up become same electric potential substantially. According to this, voltage almost equal to threshold voltage of a drive transistor generated by a compensation transistor can be certainly supplied to a gate of this drive transistor.
[0048]
In this electronic circuit, said 1st power source wire and said 2nd power source wire can electrically connect with a power supply which has same electric potential. According to this, voltage supplied to the 1st power source wire and 2nd power source wire can be made easy almost equal.
[0049]
Threshold voltage of said drive transistor is set up in this electronic circuit not become higher than threshold voltage of said compensation transistor. According to this, threshold voltage of a drive transistor can be compensated certainly.
[0050]
In this electronic circuit, larger composition of a current amount which flows into said compensation transistor than a current amount controlled by said drive transistor is preferred. According to this composition, when one [a switching transistor], it becomes possible to accumulate promptly an electric charge according to a current amount which flows into switching transistor concerned and a compensation transistor in a capacitative element.
[0051]
Various electronic devices, such as an electro-optic device, memory storage, and a sensor unit, may be constituted using at least one above-mentioned electronic circuit.
[0052]

This invention is two or more unit circuits the electro-optic device which it had, and each of two or more of said unit circuits, A drive transistor containing the 1st terminal and 2nd terminal and a compensation transistor to which said 3rd terminal was connected at a gate of said drive transistor including the 3rd terminal and 4th terminal, A switching transistor by which said 5th terminal was connected to a gate and said 3rd terminal of said drive transistor including the 5th terminal and 6th terminal, Charge quantity according to current which flows via an electrooptics element connected to said 1st terminal, and said compensation transistor and said switching transistor is held, The 1st power source wire connected to said 4th terminal including a capacitative element to which an end was connected at a gate of said drive transistor, Common connection is carried out also to said 4th terminal of other at least one unit circuit among said two or more unit circuits, it is connected to the 2nd power source wire, and said 2nd terminal is provided with a control circuit which sets said 1st power source wire as two or more potential, or controls cutting and connection between said 1st power source wire and power supply potential. Since one transistor used compared with the conventional thing is reduced according to this, compensating threshold voltage of a drive transistor, a numerical aperture is raised and it becomes possible for display quality to be high and to carry out. Since the number of transistors which constitute a unit circuit can be reduced by one piece compared with the conventional thing, a yield can be raised.

[0053]

In this electro-optic device, said electrooptics element is an organic EL device. According to this, ****** is high by reducing one transistor used compared with the conventional thing, and luminance gradation of an organic EL device can be controlled with sufficient accuracy.

[0054]

In this electro-optic device, said control circuit is a transistor containing the 7th terminal and 8th terminal, said 7th terminal is connected to a power supply, and said 8th terminal is connected to said 1st power source wire. A unit which reduced one transistor used compared with the conventional thing can be constituted easily, compensating threshold voltage of a drive transistor.

[0055]

In this electro-optic device, potential of said 1st power source wire and said 2nd power source wire at least is set up during the period when current is flowing via said compensation transistor and said switching transistor become same electric potential substantially. According to this, voltage almost equal to threshold voltage of a drive transistor generated by a compensation transistor can be certainly supplied to a gate of the drive transistor. In this electro-optic device, said 1st power source wire and said 2nd power source wire can electrically connect with a power supply which has same electric potential. According to this, voltage supplied to the 1st power source wire connected to a unit circuit and the 2nd power

source wire can be made easy almost equal.

[0056]

Threshold voltage of said drive transistor is set up in this electro-optic device not become higher than threshold voltage of said compensation transistor. According to this, threshold voltage of a drive transistor can be compensated certainly. Therefore, luminance gradation of an electrooptics element is controllable with sufficient accuracy.

[0057]

A unit circuit where this invention has been arranged corresponding to each intersection of two or more scanning lines, two or more data lines, and a scanning line of said plurality and said two or more data lines, respectively, Are two or more 1st power source wires an included electro-optic device, and each of said unit circuit, A drive transistor containing the 1st terminal and 2nd terminal and a compensation transistor to which said 3rd terminal was connected at a gate of said drive transistor including the 3rd terminal and 4th terminal, A switching transistor by which said 5th terminal was connected to a gate and said 3rd terminal of said drive transistor including the 5th terminal and 6th terminal, Charge quantity according to a current value which flows via an electrooptics element connected to said 1st terminal, and said compensation transistor and said switching transistor is held, A capacitative element to which an end was connected at a gate of said drive transistor is included, Common connection of the gate of a switching transistor contained in a series of unit circuits is carried out to one scanning line, Common connection of the 4th terminal in said a series of unit circuits is carried out to the 1st one power source wire, and it is provided with a control circuit which sets each of said 1st power source wire as two or more potential, or controls cutting and connection between the 1st one power source wire and power supply potential. Since one transistor used compared with the conventional thing is reduced compensating threshold voltage of all the drive transistors provided in a unit circuit according to this, a numerical aperture is raised and it becomes possible for display quality to be high and to carry out. Since the number of transistors which constitute a unit circuit can be reduced by one piece compared with the conventional thing, a yield can be raised.

[0058]

In this electro-optic device, common connection of the 2nd terminal in said a series of unit circuits is carried out to the 2nd one power source wire. According to this, it becomes possible for display quality to be high and to carry out.

[0059]

A gate of said compensation transistor is connected to the 3rd self terminal in this electro-optic device. According to this, voltage almost equal to threshold voltage of a drive transistor generated by a compensation transistor can be certainly supplied to a gate of the drive transistor.

[0060]
In this electro-optic device, said electrooptics element is an organic EL device. According to this, luminance gradation of an organic EL device is controllable with sufficient accuracy. In this electro-optic device, an electrooptics element of the same color was arranged along said scanning line. According to this, a numerical aperture can be raised further.
[0061]
A drive transistor in which this invention contains the 1st terminal and 2nd terminal, and a compensation transistor by which said 3rd terminal was connected to a gate of said drive transistor including the 3rd terminal and 4th terminal, A switching transistor by which said 5th terminal was connected to a gate and said 3rd terminal of said drive transistor including the 5th terminal and 6th terminal, An end a unit circuit containing a connected capacitative element to a gate of said drive transistor Two or more preparations, The 4th terminal in a series of unit circuits is a drive method of an electronic circuit by which common connection was carried out to the 1st power source wire, By making into an ON state each of a switching transistor which carries out the electrical link of each of the 4th terminal of said a series of unit circuits to prescribed potential, and is contained in said a series of unit circuits, Hold charge quantity according to current which flows via said compensation transistor to a capacitative element, and voltage according to said charge quantity is impressed to said drive transistor, A step which sets up switch-on between said 1st terminal and said 2nd terminal, and a step which separates electrically each of the 4th terminal of said a series of unit circuits from said prescribed potential are included. According to this, threshold voltage of a drive transistor can be compensated and an electronic circuit can be made to drive.
[0062]
A drive transistor in which this invention contains the 1st terminal and 2nd terminal, and a compensation transistor by which said 3rd terminal was connected to a gate of said drive transistor including the 3rd terminal and 4th terminal, A switching transistor by which said 5th terminal was connected to a gate and said 3rd terminal of said drive transistor including the 5th terminal and 6th terminal, A unit circuit containing an electrooptics element connected to said 1st terminal and a capacitative element to which an end was connected at a gate of said drive transistor, Corresponding to each intersection of two or more scanning lines and two or more data lines, it is arranged, respectively, Common connection of the gate of a switching transistor contained in a series of unit circuits is carried out to one scanning line, The 4th terminal in said a series of unit circuits is a drive method of an electro-optic device by which common connection was carried out to the 1st one power source wire, Supply a scanning signal to a gate of a switching transistor which carries out the electrical link of each of the 4th terminal of said a series of unit circuits to prescribed potential, and is contained in said a series of unit circuits, respectively, and as an ON state, Charge quantity according to a current level of

current which flows into a period electrically connected with the data line with which said two or more data lines correspond via said compensation transistor is held to a capacitative element, Voltage according to said charge quantity is impressed to said 1st gate, and a step which sets up switch-on between said 1st terminal and said 2nd terminal, and a step which separates electrically each of the 4th terminal of said a series of unit circuits from said prescribed potential are included. According to this, threshold voltage of a drive transistor can be compensated and an electro-optic device can be made to drive.

[0063]

Since electronic equipment of this invention mounts the above-mentioned electronic circuit or the above-mentioned electro-optic device, Since threshold voltage of a drive transistor in a circuit can be compensated and also one transistor used compared with the conventional thing can be reduced, a yield of electronic equipment can be raised.

[Effect of the Invention]

[0064]

As explained above, according to this invention, influence of the variation in a drive transistor is made hard to be influenced, and it becomes possible to supply target current to the current type driven element of an organic EL device etc.

[Best Mode of Carrying Out the Invention]

[0065]

Hereafter, the embodiment of this invention is described with reference to drawings.

<A 1st embodiment>

First, a 1st embodiment of this invention is described. Drawing 1 is a figure showing the composition of the electro-optic device with which the unit circuit concerning a 1st embodiment is applied. In [as shown in this figure] this electro-optic device, While being allocated so that two or more scanning line (S1, S2, S3, ...) and two or more data lines (D1, D2, D3, ...) may cross mutually, the pixel circuit 20 which is an example of the unit circuit concerning this embodiment is established in each of the intersection at matrix form, respectively.

[0066]

The scanning line driving circuit 130 receives without the scanning line S1, S2, S3, and ...., and impresses the selection potential Vsel to predetermined timing, respectively. The data line driving circuit 140 receives without the data line D1, D2, D3, and ...., and supplies data-currents Idata as a data signal, respectively.

[0067]

In drawing 1, the power source wire V mentioned later is omitted. In this explanation, the pixel circuit 20 may call a display panel the portion arranged to matrix form. In this embodiment, although one of the pixels which should be displayed supports the one pixel circuit 20, it is good also as composition which displays one pixel by two or more sub pixels.

[0068]
Drawing 2 (a) is a circuit diagram showing the detailed composition of the pixel circuit 20 as a unit circuit concerning this embodiment. The pixel circuit in this figure is one of the things corresponding to intersection with the general scanning line S and data-line D.
[0069]
In this figure, the driven element L is an organic EL device by which a current drive is carried out, for example, and it has written as a diode with this figure. This unit circuit besides the driven element L Drive transistor Tr1, switching transistor Tr2 (the 2nd switching transistor), The capacitative element C which accumulates switching transistor Tr3 (the 1st switching transistor), compensation transistor Tr4, and an electric charge is included. Among these, each of drive transistor Tr1 and compensation transistor Tr4 is p channel type thin film transistors with little degradation with the passage of time (Thin Film Transistor:TFT), and switching transistor Tr2 and Tr3 are n channel type TFT(s).
[0070]
Selection of whether to use a p channel type or which an n channel type conductivity type for each transistor is not necessarily restricted to what was shown here. About switching transistor Tr2 and Tr3 conductivity type (is it an n channel type or is a p channel type?), it may differ mutually. However, to change the conductivity type of switching transistor Tr2 and Tr3 mutually, it is necessary to form separately the scanning line which takes a logical level with this exclusive in addition to the scanning line S, and to connect the gate of the switching transistor which takes a p channel type.
[0071]
While one end of the driven element L is connected to the drain of drive transistor Tr1 via the electrode for hole injections which is not illustrated, the other end of the driven element L is connected to the negative pole E.
[0072]
While the sauce of drive transistor Tr1 is connected to the power source wire V, the gate is connected to the end of the capacitative element C, the drain of switching transistor Tr3, and the drain of transistor Tr4, respectively. The other end of the capacitative element C is connected to the power source wire V.
[0073]
The drain of compensation transistor Tr4 is connected to the self gate. Therefore, compensation transistor Tr4 is diode connection.
[0074]
The drain and gate of compensation transistor Tr4, It is connected to the end (the gate of drive transistor Tr1, the drain of switching transistor Tr3) of the capacitative element C, and the sauce of compensation transistor Tr4 is connected to the sauce of switching transistor Tr2.

The drain of switching transistor Tr2 is connected to the power source wire V. The sauce of switching transistor Tr3 is connected to data-line D, and the gate of switching transistor Tr2 and Tr3 is connected to the scanning line S, respectively.

[0075]

Below, operation of the unit circuit of drawing 2 (a) is explained. On-off control of switching transistor Tr2 and Tr3 is carried out by the selection potential Vsel impressed to each gate via the scanning line S. In this embodiment, since both switching transistor Tr2 and Tr3 are n channel types, when the selection potential Vsel is high-level, they become one here, respectively. Since the gate of compensation transistor Tr4 and the potential of sauce will become equal if data-currents Idata is supplied via data-line D when switching transistor Tr2 and Tr3 are in the state of one, it is at compensation transistor Tr4,

Vgs(potential difference of gate and sauce) =Vds (potential difference of a drain and sauce)

The capacitative element C stores electricity the electric charge corresponding to a next door and this state, and, thereby, the voltage between terminals of the capacitative element C is impressed to the gate of drive transistor Tr1. That is, the gate voltage of drive transistor Tr1 will be controlled by quantity of data-currents Idata supplied from data-line D, the current amount between the drain sauce of drive transistor Tr1 will be controlled by this, and the value of the current Ids which flows through the driven element L will be controlled.

[0076]

In the above-mentioned circuit, drive transistor Tr1 and compensation transistor Tr4, What is called a current mirror circuit is constituted, and the value of the current Ids between the drain sauce of drive transistor Tr1, i.e., the value of the current supplied to the driven element L, is proportional to the current amount between the drain sauce of compensation transistor Tr4.

[0077]

The ratio of the current Ids between the drain sauce of drive transistor Tr1 and data-currents Idata which flows between the drain sauce of compensation transistor Tr4 becomes settled with the characteristic of drive transistor Tr1 and compensation transistor Tr4. By therefore, the thing for which the gain coefficient (current amount which flows into the transistor when fixed voltage is impressed to the gate and sauce of a transistor) which is one of the characteristics of drive transistor Tr1 and compensation transistor Tr4 is coincided. The current Ids which flows into drive transistor Tr1, and data-currents Idata which flows through compensation transistor Tr4 can be coincided. In this embodiment, since direct continuation especially of the drain of compensation transistor Tr4 is carried out to the gate of drive transistor Tr1, Data-currents Idata which passes compensation transistor Tr4 is directly reflected in the current Ids controlled by a drive transistor, and both conformity can be improved.

[0078]

For this reason, if a display panel is constituted so that it may be in agreement in the gain

coefficient of drive transistor Tr1 and compensation transistor Tr4, Even if variation occurs in drive transistor Tr1 currently formed for every pixel of a display panel even if, the current Ids of the same size as the driven element L contained in each pixel of a display panel can be supplied. Therefore, the luminosity unevenness resulting from the characteristic variation of drive transistor Tr1 can be suppressed.

[0079]

In the manufacturing process of the display panel containing the driven element L, it is easy to coincide the characteristic of the approaching transistor mutually as known well. As mentioned above, in this embodiment, direct continuation of the drain of compensation transistor Tr4 is carried out to the gate of drive transistor Tr1, and it is close to a forge fire. For this reason, in the same pixel circuit, it is not difficult to constitute the gain coefficient of drive transistor Tr1 and compensation transistor Tr4 so that it may be in agreement, therefore it is comparatively easy to manufacture a display panel with little luminosity unevenness.

[0080]

Although the gate voltage of drive transistor Tr1 is set up in this embodiment according to data-currents Idata supplied by the data line driving circuit 140, Since drive transistor Tr1 and compensation transistor Tr4 constitute what is called a current mirror circuit, stabilizing also becomes change of the current Ids between the drain sauce of drive transistor Tr1 by a temperature change etc. being controlled, and planned.

[0081]

Although compensation transistor Tr4 is made to intervene between switching transistor Tr2 and switching transistor Tr3, it may be made to make it intervene between switching transistor Tr2 and the power source wire V in the circuit of drawing 2 (a), as shown in drawing 2 (b). Also in this circuit, the current Ids between drain sauce of drive transistor Tr1 of becoming settled by data-currents Idata which flows through compensation transistor Tr4 is the same as that of the circuit shown in drawing 2 (a).

[0082]

Drawing 3 is a timing chart for explaining operation of the unit circuit shown in drawing 2 (a).

[0083]

First, while the scanning line driving circuit 130 makes high-level selection potential Vsel supplied to the scanning line S, the data line driving circuit 140 supplies data-currents Idata to data-line D.

[0084]

Since both switching transistor Tr2 and Tr3 will be turned on if the selection potential Vsel becomes high-level, data-currents Idata, It flows in the course the power source wire V, switching transistor Tr2, compensation transistor Tr4, switching transistor Tr3, and data-line D.

[0085]

While the gate voltage of drive transistor Tr1 is defined, the current Ids according to this gate voltage is supplied from the power source wire V according to this data-currents Idata and the driven element L emits light, this gate voltage is held by the capacitative element C. Therefore, since the current Ids according to the held gate voltage continues flowing into the driven element L even if the selection potential Vsel is set to a low level and both switching transistor Tr2 and Tr3 are turned off, The luminescent state of the driven element L will be maintained until the selection potential Vsel becomes high-level again next time.

[0086]

By the way, the gain coefficient of drive transistor Tr1 and compensation transistor Tr4 which constitute the current mirror circuit, As mentioned above, when it coincides this, it is not restricted, but according to the demand of versatility, such as size of the display panel in which this unit circuit is applied, and scan frequency, it can set up suitably.

[0087]

For example, it is good also as composition which made the gain coefficient of compensation transistor Tr4 larger than the gain coefficient of drive transistor Tr1. Since the current Idata which flows into compensation transistor Tr4 becomes larger than the current Ids which flows into drive transistor Tr1 according to such composition, the time which a charge storage takes in the capacitative element C can be shortened. For this reason, it becomes possible to cope with high-frequency-ization of the scan frequency demanded with increase of the pixel number of a display panel, or large-size-izing.

[0088]

Contrary to this, it is good also as composition which made the gain coefficient of compensation transistor Tr4 smaller than the gain coefficient of drive transistor Tr1. Since data-currents Idata by compensation transistor Tr4 becomes smaller than the current Ids by drive transistor Tr1 according to this composition, the electric power consumed in the case of the charge storage in the capacitative element C can be stopped.

[0089]

In drawing 2 (a) or drawing 2 (b), the gate of switching transistor Tr2 in the pixel circuit 20 of the same line and Tr3 had become the composition mutually connected to the same scanning line S. It is good also as composition connected to the scanning line S with which it is not restricted to this composition, a different scanning line from the scanning line S is formed, namely, two scanning lines per line are formed, and the gates of switching transistor Tr2 and Tr3 differ mutually. If both composition is compared, the direction of composition (composition which has one scanning line per pixel circuit 20 of one line) of starting the former compares with the composition (composition which has two scanning lines per pixel circuit 20 of one line) concerning the latter here, Since there are few fields which wiring takes and they end, improvement in the numerical aperture by securing an effective optical surface product

becomes easy.

[0090]

Next, the manufacturing process of TFT and a pixel is explained about the manufacturing process in the above-mentioned pixel circuit 20.

[0091]

First, by PECVD which used SiH_4 on the glass substrate 1, and LPCVD using Si_2H_6, while forming an amorphous silicon, This amorphous silicon is made to polycrystal-ize with laser radiation, such as an excimer laser, and solid phase growth, and the polycrystalline silicon layer 2 is formed (refer to drawing 4 (a)).

[0092]

After patterning the polycrystalline silicon layer 2 and forming the gate dielectric film 3, the gate 4 is formed further (refer to drawing 4 (b)).

[0093]

Then, impurities, such as Lynn and boron, are driven into the polycrystalline silicon layer 2 in self align, using the gate 4 as a mask, and the transistors 5a and 5b are formed. Here, the conductivity types of the transistors 5a and 5b are a p type and a n type, respectively. After forming the 1st interlayer insulation film 6, a contact hole is punctured and sauce and the drain 7 are formed further (refer to drawing 4 (c)).

[0094]

And after forming the 2nd interlayer insulation film 8, a contact hole is punctured and the picture element electrode 9 which consists of ITO(s) (Indium Tin Oxide) further is formed (refer to drawing 4 (d)).

[0095]

The adhesion layer 10 is formed and an opening is formed corresponding to a luminous region so that the 2nd interlayer insulation film 8 and the picture element electrode 9 which were formed in this way may be covered. The layer intermediate layer 11 is formed and, similarly an opening is formed corresponding to a luminous region (refer to drawing 5 (a)).

[0096]

Next, the wettability of a substrate face is controlled by plasma treatment, such as oxygen plasma and CF_4 plasma. Then, the hole injection layer 12 and the luminous layer 13 are formed according to a liquid phase process or a vacuum process, respectively. A spin coat, squeegee coating, an ink jet process, etc. are mentioned to a liquid phase process, and sputtering, vacuum evaporation, etc. are mentioned to a vacuum process. The negative pole 14 having contained metal, such as aluminum, is formed. Finally, the sealing layer 15 is formed and an organic EL device is completed (refer to drawing 5 (b)).

[0097]

Here, there is a role of the adhesion layer 10 in improving the adhesion of a substrate and the

layer intermediate layer 11, and obtaining an exact emission area. When the layer intermediate layer's 11 role forms the hole injection layer 12 and the luminous layer 13 in keeping away the negative pole 14 from the gate 4, sauce, and the drain 7, and reducing parasitic capacitance, and a liquid phase process, there is in controlling surface wettability and being able to be made to perform exact patterning. An electron transport layer (not shown) may be provided on the luminous layer 13.

<A 2nd embodiment>

By forming in a 1st embodiment mentioned above, so that the gain coefficient of drive transistor Tr1 and compensation transistor Tr4 may become the same for example, The current Ids between the drain sauce of drive transistor Tr1 was able to be coincided with data-currents Idata which flows between the drain sauce of compensation transistor Tr4. For this reason, even if characteristic variation occurred in drive transistor Tr1, the current Ids of the same size as the driven element L could be supplied over each pixel, and it became possible to suppress the luminosity unevenness resulting from the characteristic variation of a drive transistor.

[0098]

However, in a 1st embodiment, in one pixel, a total of four transistors are required so that clearly from drawing 2 (a) or drawing 2 (b). For this reason, when it sees as a display panel, only the part of the number of transistors tends to cause the fall of the yield, and decline in a numerical aperture.

[0099]

Then, after suppressing the luminosity unevenness resulting from the characteristic variation of drive transistor Tr1, a 2nd embodiment that decreased the number of the transistor which is needed in one pixel will be described.

[0100]

Drawing 6 is a block diagram showing the composition of the organic electroluminescence display to which the unit circuit concerning a 2nd embodiment is applied.

[0101]

As shown in this figure, the organic electroluminescence display 100 is provided with the signal generating circuit 110, the display panel part 120, the scanning line driving circuit 130, the data line driving circuit 140, and the power source wire control circuit 150.

[0102]

The signal generating circuit 110 in the organic electroluminescence display 100, the scanning line driving circuit 130, the data line driving circuit 140, and the power source wire control circuit 150 may be constituted by the electronic parts in which each became independent. For example, the signal generating circuit 110, the scanning line driving circuit 130, the data line driving circuit 140, and the power source wire control circuit 150 may be respectively

constituted by the semiconductor integrated circuit device of one chip. All or some of the signal generating circuit 110, the scanning line driving circuit 130, data line driving circuit 140, and power source wire control circuits 150 may comprise a programmable IC chip, and the function may be realized by software by the program written in the IC chip concerned.

[0103]

The signal generating circuit 110 creates the scanning-controls signal and data control signal for displaying a picture on the display panel part 120 based on the image data from the external device which is not illustrated. And the signal generating circuit 110 outputs said data control signal to the data line driving circuit 140 while outputting said scanning-controls signal to the scanning line driving circuit 130. The signal generating circuit 110 outputs a timing control signal to the power source wire control circuit 150.

[0104]

Drawing 7 is a figure showing the internal configuration of the display panel part 120 and the data line driving circuit 140. As shown in this figure, the display panel part 120, It has the pixel circuit 200 as a unit circuit, respectively in the position corresponding to the intersection of the data line Xm (m= 1 - M;m are integers) of M book prolonged along a column direction, and the scanning line Yn (n= 1 - N;n are integers) of N book prolonged along with a line writing direction. That is, by being connected to the data line Xm prolonged along a column direction, and the scanning line Yn prolonged along with a line writing direction, respectively, each pixel circuit 200 is arranged to matrix form, and constitutes the electronic circuit.

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[0177]
[Drawing 1]It is a block diagram showing the composition of the electro-optic device which applied the unit circuit concerning the 1st example of this invention.
[Drawing 2](a) and (b) are the figures showing the composition of the pixel circuit as a unit circuit, respectively.
[Drawing 3]It is a timing chart for explaining the drive method of the pixel circuit.
[Drawing 4](a) - (c) is a figure showing a part of manufacturing process of the electro-optic device, respectively.
[Drawing 5](a) And (b) is a figure showing a part of manufacturing process of the electro-optic device, respectively.
[Drawing 6]It is a block diagram showing the composition of the electro-optic device which applied the unit circuit concerning the 2nd example of this invention.
[Drawing 7]It is a figure showing the composition of the display panel in the electro-optic device, etc.
[Drawing 8]It is a figure showing the composition of the pixel circuit as the unit circuit.
[Drawing 9]It is a timing chart for explaining the drive method of the pixel circuit.
[Drawing 10]It is a figure showing the composition of a display panel etc. among the electro-optic devices concerning the application of a 2nd embodiment.
[Drawing 11]It is a perspective view showing the composition of the mobile type personal computer which applied the electro-optic device including the unit circuit concerning an embodiment.
[Drawing 12]It is a perspective view showing the composition of the portable telephone which applied the electro-optic device.
[Drawing 13]It is a perspective view showing the composition of the digital still camera which

applied the electro-optic device.

[Drawing 14]It is a figure showing an example of the conventional unit circuit which drives a current type driven element.

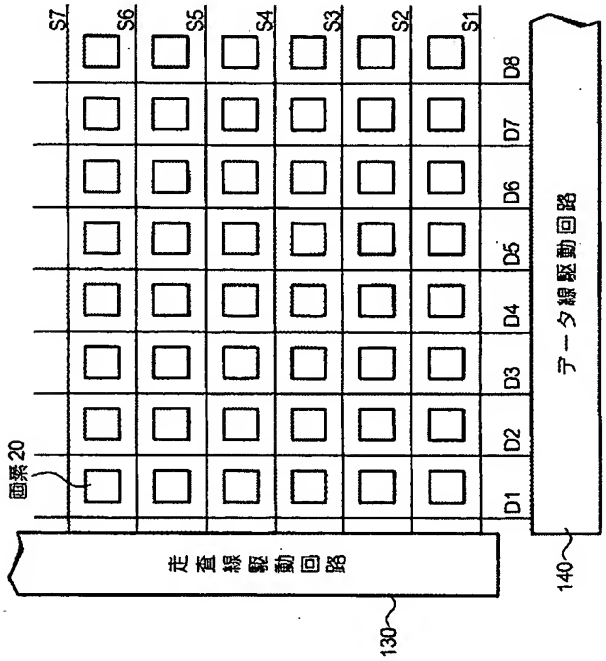
[Translation done.]

* NOTICES *

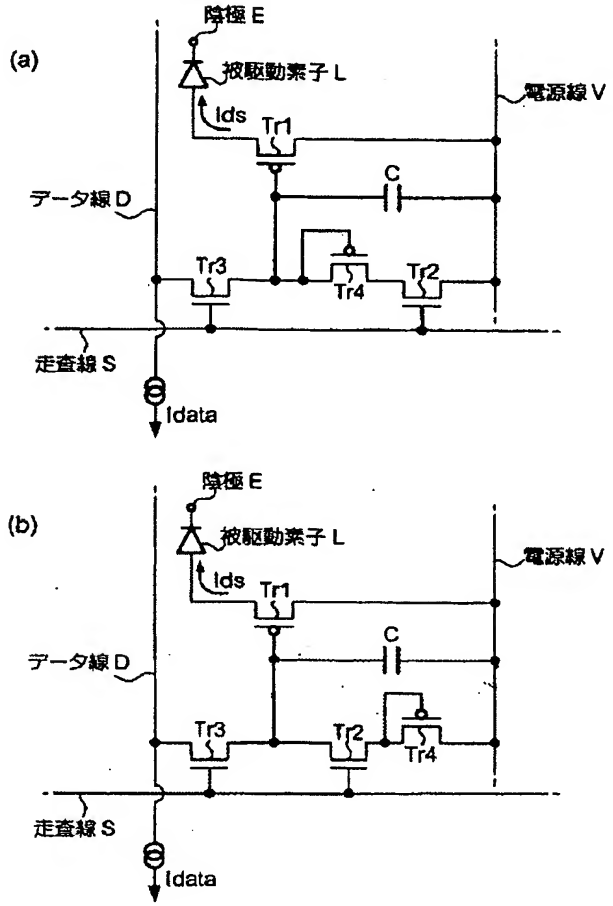
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

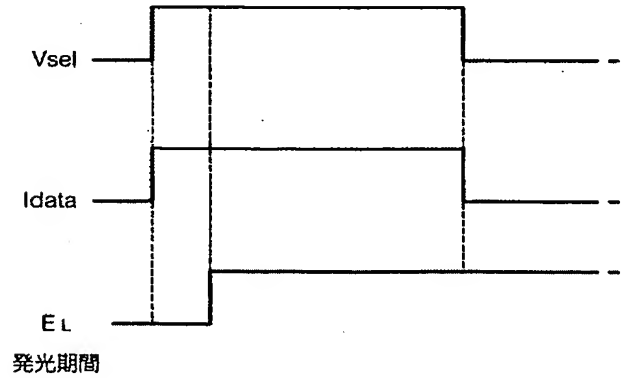
[Drawing 1]



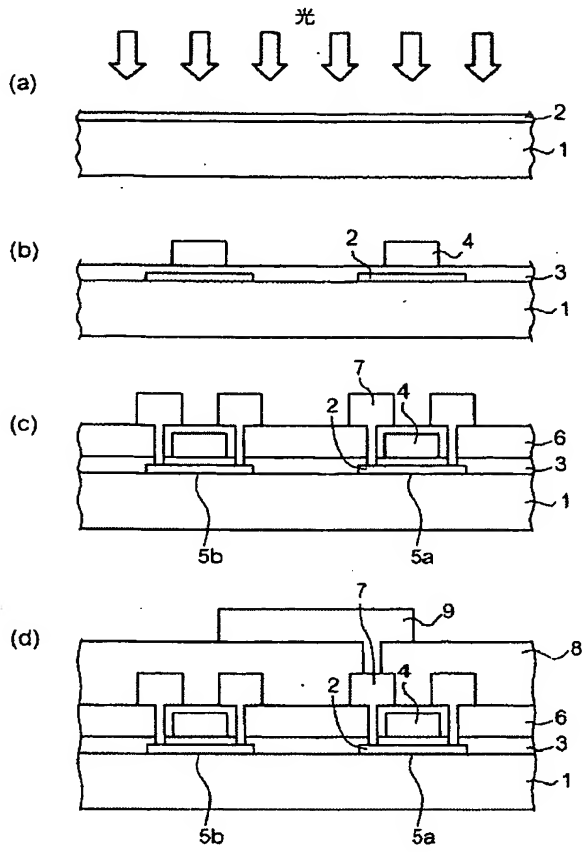
[Drawing 2]



[Drawing 3]

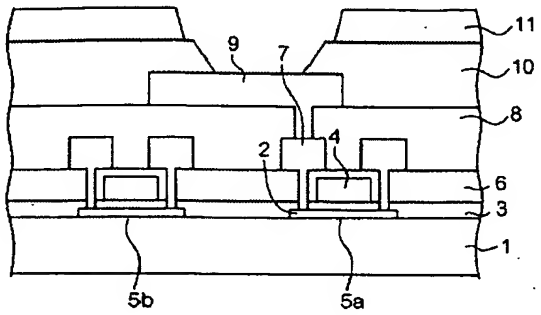


[Drawing 4]

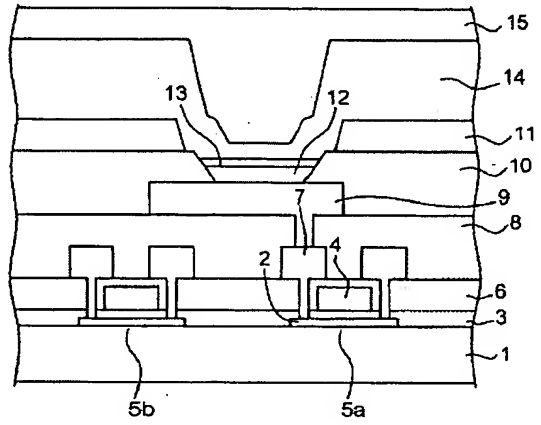


[Drawing 5]

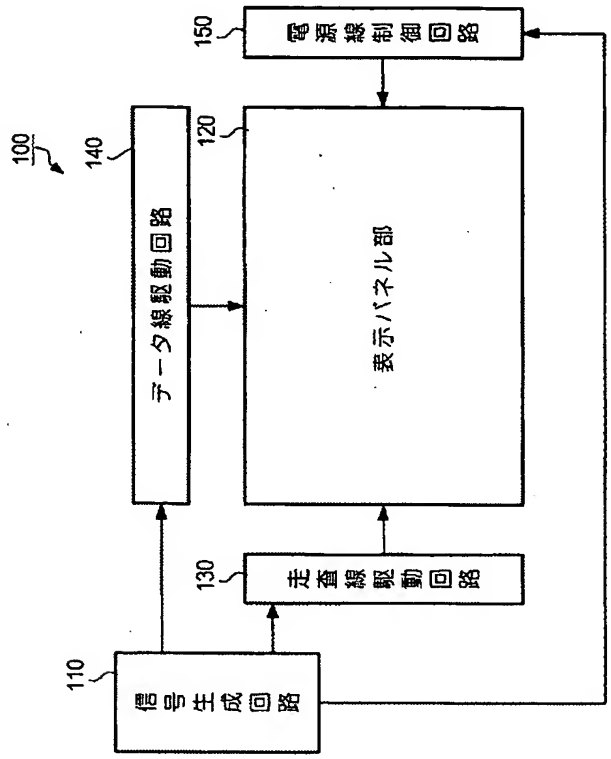
(a)



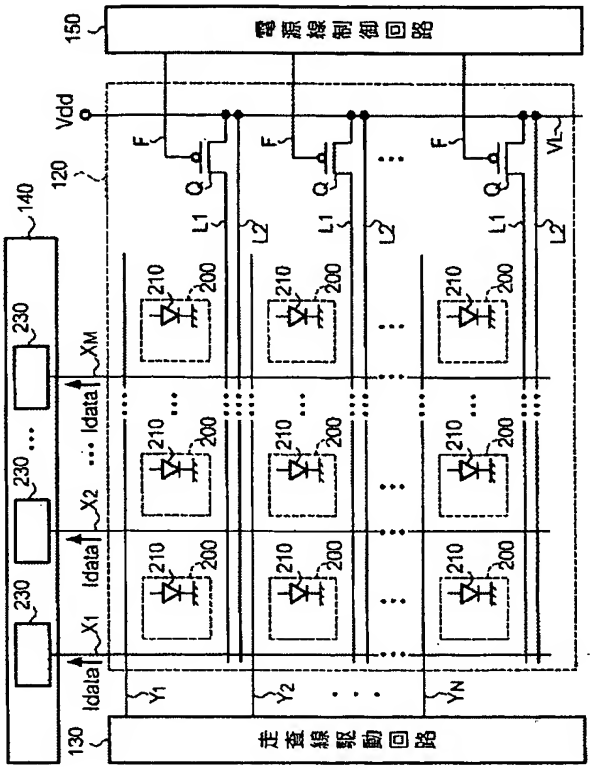
(b)



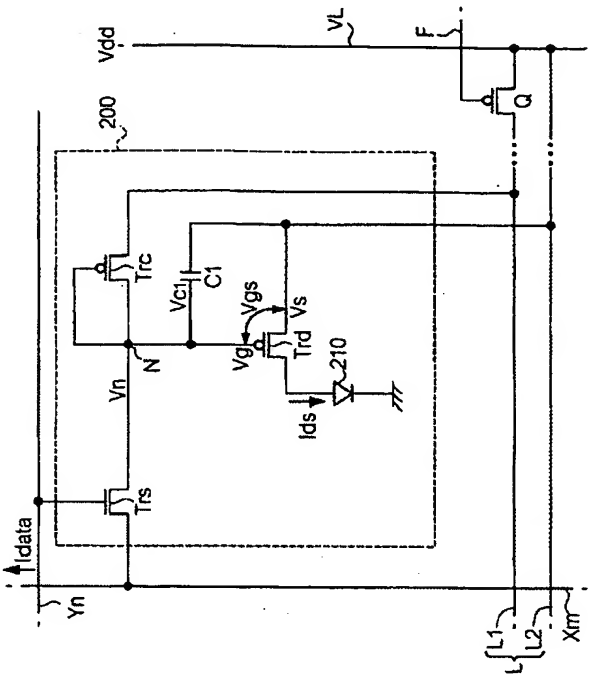
[Drawing 6]


150
電源線制御回路
100
140
120
データ線駆動回路
表示パネル部
130
走査線駆動回路
110
信号生成回路

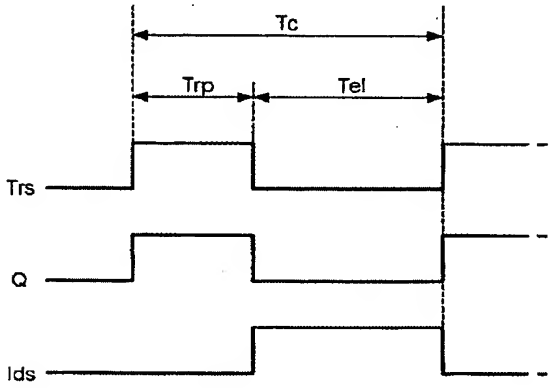
[Drawing 7]


150
電源線制御回路
Vdd
120
140
F
Q
L1
L2
VL
210
200
230
XM
Idata
X2
X1
Y1
Y2
YN
130
走査線駆動回路

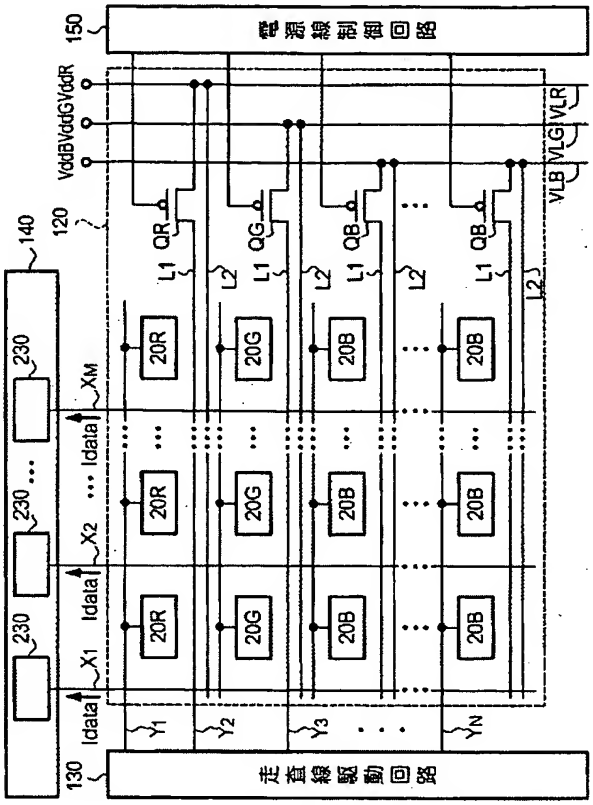
[Drawing 8]



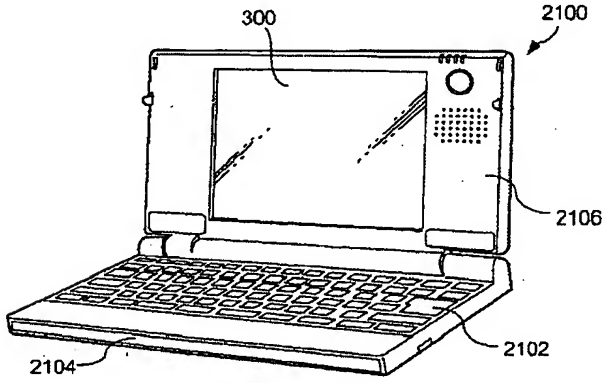
[Drawing 9]



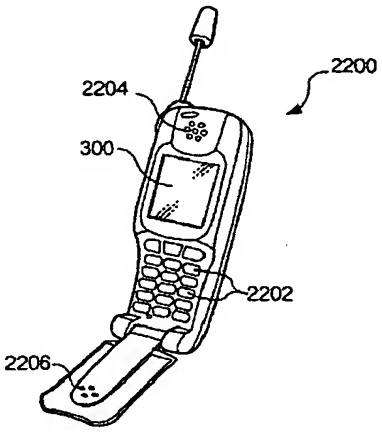
[Drawing 10]



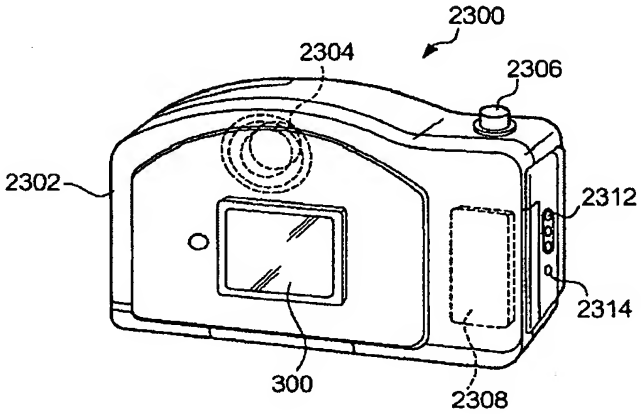
[Drawing 11]



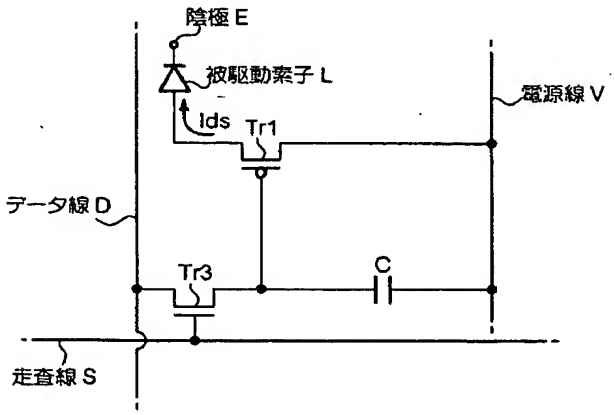
[Drawing 12]



[Drawing 13]



[Drawing 14]



[Translation done.]